## OFF

### 1

#### Interp and violation: Affirmatives may not defend only specific instances of outer space appropriation by private entities as unjust.

#### "The" can either indicate a definite generic or definite description

Ojeda 91 [Almerindo E. Ojeda, PhD linguistics from UChicago, professor of linguistics at UC Davis. "Definite Descriptions and Definite Generics", Linguistics and Philosophy, Vol. 14, No. 4, pp. 367-397, Published August 1991, https://www.harvardlds.org/wp-content/uploads/2019/04/1-s2.0-S0010027718300313-main-3.pdf] HWIC

A definite noun phrase may be taken either as a definite description or as a definite generic. Thus, a noun phrase like the origin of the ballad may denote either the origin of an individual ballad we have been discussing, or else the origin of ballads in general as a literary species. In the first case, the ballad has been taken as a definite description; in the second, it has been taken as a definite generic.2 Notice that the ambiguity between definite descriptions and definite generics can be resolved in certain con texts. Thus, the definite noun phrase the computer is taken only as a definite description in (la), a statement about an individual computer; it is taken only as a definite generic in (lb), a statement about computers in general. Similarly, the definite noun phrase the dodo may be taken as a definite description in (2a) while it must be taken as a definite generic in (2b).3

(1)a. Turing repaired the computer.

b. Turing invented the computer.

(2)a. The dodo is dead.

b. The dodo is extinct.

#### Moral statements are generic normative principles – necessitates the generic interpretation

McDonald 09 [Hugh P. McDonald, professor of philosophy at the New York City College of Technology. "Principles: The Principles of Principles." The Pluralist, vol. 4, no. 3, [University of Illinois Press, Society for the Advancement of American Philosophy], 2009, pp. 98–126, https://www.jstor.org/stable/20708996] HWIC

"Principle" has a great many meanings: origin, beginning, cause, rule, axiom, and so on.5 However, we cannot assume any necessary relation of these meanings. They may be distinct meanings without relations. Neverthe less we can trace some common roots and thereby interconnections of the meanings. I will concentrate here on certain meanings relevant to the prin ciple of principles, that principles are actual. One meaning is that principles are the "ultimate source, origin, or cause of something" or the "originating or actuating agency or force." Principles are connected with the origin and cause of any "something." Moreover, principles may cause the actuality of the something. A second meaning of principles is that they regulate change, whether internally, as the "method of operation of a thing," or as an external cause. That is, principles are regulative, especially including rules for opera tions, involving changes. As rules, they are universal for a kind, although there may be exceptions to them in certain modes. A principle, then, is an originating rule that universally regulates the formation, operation, or other changes of any actuality, which as universal applies to that kind of thing. Machines may be built according to a principle and operate on the same or even a different principle. Ships presume the principle of floatation but may be built according to principles of woodworking or those of other materials. The principle can have different modes?whether necessary, as in logical inference; general, as in scientific laws; or actualization of possibilities, as in machines or as in moral principles that we follow, but could do otherwise.6 I will cover modes below.

Principles are also a cause as regulative, combining cause and rule. The principle can be external, as in a chemical catalyst; or internal, as in geneti cally caused changes.7 Both kinds of causes involve relations. Internal prin ciples exhibit "tendencies," to borrow the word used in the dictionary. They continue to operate across time. Actions that come under principles may be of kinds whose causes are separate in time, since we may cease an action for a time and then take it up again; while genetic characteristics are tenden cies whose causes are connected by reproduction. As causal, principles may be originary for a kind. Especially in new technologies, for example, flying machines, the principle that organisms could fly (birds, bats, and insects) preceded the invention of the technology, although the principles of aero dynamics were discovered later. However, flying utilized and actualized the latter principles. In this sense, principles can be constitutive rules as the origin of a kind, whether generic or specific.

External principles are regulative and not attributes. They regulate change, such that change is not chaotic. Principles are not bodies, objects, or entities but are the basis of the judgment or evaluation that the latter will persist, since they follow or are regulated by principles. Moreover, there is another sense in which principles are not attributes, since the relation of bodies, ob jects, or other terms for actualities implies a common principle, an identity that is regulated and constituted by the same actual principle. "Object" is a principle uniting instances normatively, for example, that solids persist unless acted upon by heat, etc.

Scientific, engineering, and practical laws are cases of principles. The "law of gravity" is the principle of gravity. Rules of "right conduct" also exhibit laws. Principles form an identity of different instances that fall under the law, whether generally or invariably. Laws and rules are regulative identities, applicable to different instances, and whether originary, constitutive, or ex ternally regulative. Voluntary adherence to a rule is bringing actions in line with a principle or enacting a principle.

Since principles are general, the statement of a principle includes an abstraction of some identity element of the instance. Principles, then, can constitute the elements in any instance insofar as there are identical ele ments, such as matter, species, and genera. This abstraction both identifies the instance as alike with other instances in some respect and differentiates it from those that do not exhibit the principle. The instance may contain several principles conjointly, matter, the state of the matter, function, aes thetic element, and many others. Thus principles connect like instances in a very complex set of relations. A diamond and a painting may share aesthetic qualities but their material, functional, and cultural principles may be quite different. Since identity and difference are correlative terms, every identity is also a difference and this principle applies to actual principles in the world, one principle of principles. To identify a rock of a certain type as consisting in certain chemical combinations connects it with that kind of mineral in general but also certain chemical elements in general, their physical proper ties (such as consisting of a certain atomic number of protons, electrons, and the like), and other principles. However, it also differentiates the rock from other types with their own specific principles, although some generic prin ciples may overlap, namely, the physical properties of all chemical elements as consisting in protons, electrons, and other principles of atoms. Principles then mark both a difference and an identity. The principles identify a distinc tion, but such identifications differentiate from other identifying principles. The wavelengths for green light are identical at different times of emission from the sun but are not identical with those for red.

#### Negate –

**1] Precision:**

**A] Topicality is a constitutive rule of the activity and a basic aff burden, they agreed to debate the topic when they came to the tournament**

**B] Jurisdiction --** **you can’t vote affirmative if they haven’t affirmed**

**C] It’s the only stasis point we know before the round so it controls the internal link to engagement, and there’s no way to use ground if debaters aren’t prepared to defend it.**

**2] Limits: every specific instance or combination of instances of appropriation could be an aff like individual missions, programs or satellites, compounded by broad definitions of appropriation – unlimited topics incentivize obscure affs that negs won’t have prep on – limits are key to reciprocal prep burden. This topic already has very few neg generics and spec kills the innovation DA and space appropriation good – also means there is no universal DA to spec affs**

**Drop the debater – their abusive advocacy skewed our 1NC construction, allowing 1AR restart doesn't solve. They say 1AR too short to make up for time tradeoff, but they get out of most DA’s and CP’s, means they should be able to defend the wording of their aff.**

**Competing interps on T –** **topicality is a yes/no question, you can’t be reasonably topical, only competing interps create norms -- reasonability is arbitrary and invites judge intervention causing a race to the bottom of questionable argumentation**

### 2

#### CP: Private entities ought to place 250 Earth Observation satellites in Geostationary Orbit and replace those satellites upon removal or destruction

#### Solves stationary EO – continued observation

NESDIS n.d. “Geostationary Satellites” <https://www.nesdis.noaa.gov/current-satellite-missions/currently-flying/geostationary-satellites> TG

NOAA’s most sophisticated Geostationary Operational Environmental Satellites (GOES), known as the GOES-R Series, provide advanced imagery and atmospheric measurements of Earth’s Western Hemisphere, real-time mapping of lightning activity, and improved monitoring of solar activity and space weather.

GOES satellites orbit 22,236 miles above Earth’s equator, at speeds equal to the Earth's rotation. This allows them to maintain their positions over specific geographic regions so they can provide continuous coverage of that area over time.

#### EO sats observe and solve

Alonso 18 [(Elisa Jiménez, communications consultant with Acclimatise, climate resilience organization) “Earth Observation of Increasing Importance for Climate Change Adaptation,” Acclimatise, May 2, 2018, <https://www.acclimatise.uk.com/2018/05/02/earth-observation-of-increasing-importance-for-climate-change-adaptation/>] TDI

Earth observation (EO) satellites are playing an increasingly important role in assessing climate change. By providing a constant and consistent stream of data about the state of the climate, EO is not just improving scientific outcomes but can also inform climate policy.

Managing climate-related risks effectively requires accurate, robust, sustained, and wide-ranging climate information. Reliable observational climate data can help scientists test the accuracy of their models and improve the science of attributing certain events to climate change. Information based on projections from models and historic data can help decision makers plan and implement adaptation actions.

Providing information in data-sparse regions

Ground-based weather and climate monitoring systems only cover about 30% of the Earth’s surface. In many parts of the world such data is incomplete and patchy due to poorly maintained weather stations and a general lack of such facilities.

EO satellites and rapidly improving satellite technology, especially data from open access programmes, offer a valuable source information for such data-sparse regions. This is especially important since countries and regions with a lack of climate data are often particularly vulnerable to climate change impacts.

#### Their preempts form the Ding ev:

#### 1] Replacement solves longevity

#### 2] Stationary observation solves long term trends

#### 3] Large quantity of sats allow universal coverage in all conditions

#### 1AR theory is skewed towards the aff – a) the 2NR must cover substance and over-cover theory, since they get the collapse and persuasive spin advantage of the 3min 2AR, b) their responses to my counter interp will be new, which means 1AR theory necessitates intervention. Implications – a) reject 1AR theory since it can’t be a legitimate check for abuse, b) drop the arg to minimize the chance the round is decided unfairly, c) use reasonability with a bar of defense or the aff always wins since the 2AR can line by line the whole 2NR without winning real abuse

#### Condo advantage counterplans are good – key to test the intrinsicness of aff impacts – winning a straight turn doesn’t prove the aff is a good idea or better than the squo which is the aff’s burden, and no policymaker would implement a proposal just because it’s not the worst idea which also justifies judge kick because even if the 2AR proves the counterplan is bad it doesn’t prove the aff is good.

## ON

### Solvency

#### They haven't fiated the creation of lunar heritage sites, which don't exist yet, so they don't prohibit the appropriation of anything- vote neg on presumption. Also, the card they used doesn’t depict lunar heritage sites that actually exists lol, it just shows sites NASA says should be considered to be lunar heritage sites in the future.

#### Whoops they can’t solve- non-appropriation doesn’t create “preservation”- they’ll pollute the site without appropriation! Vote neg on presumption- their card

Smith 19 Belinda Smith 7-18-2019 "Who protects Apollo sites when no-one owns the Moon?" https://www.abc.net.au/news/science/2019-07-19/apollo-11-moon-landing-heritage-preservation-outer-space-treaty/11055458 (Strategic Communications Advisor at Department of Education and Training at University of Victoria)Elmer

It was July 20, 1969, and way past Pete Capelotti's bedtime. But as the nine-year-old sat in his family's living room in Massachusetts watching the live broadcast of Neil Armstrong and Buzz Aldrin step out of the Apollo 11 lander and onto the lunar surface, sleep was the last thing on his mind. "I just remember being so terrified for [the astronauts] when they landed because I was afraid monsters were going to eat them," he recalled. Of course, Armstrong and Aldrin didn't encounter any alien beasts during their two-and-a-half-hour moonwalk. And that boy grew up to become a historical archaeologist. He's still highly protective of what's on the Moon, but rather than concern for astronauts, it's now for the stuff they left behind. That's because historic moon sites like Tranquility Base — which is the Apollo 11 landing site — don't have legal protection. In other words, if someone scuffed out the footprints and rover tracks in the moon dust, they'd return to Earth to face a whole lot of angry people, but they won't have broken any laws. This may not have been such an issue in recent decades, but there's bound to be a lot more human activity heading to the Moon in the not-too-distant future. There's the possibility of mining the Moon for rare-earth minerals. Many countries and private companies have their sights set on the Moon. For example, NASA intends to return in the next five years; China, which already has a mission on the far side of the Moon, is considering setting up a space station sometime after 2030; and SpaceX wants to fly a private passenger to the Moon in 2023. The SpaceX mission won't drop anyone on the Moon's surface. They'll cut a lap before returning to Earth. But, Professor Capelotti said, it's just a matter of time before tourists set foot on the lunar surface and when they do, they'll want to visit the Apollo 11 lander. "You'll never get a second chance to preserve these sites," he said.

\*\*\*THEIR CARD STARTS

It's not just about history Alongside heritage value, the bits and pieces left on the Moon have enormous scientific significance. Take moon dust. It's a real problem for moon-bound equipment because it's made of fine, super sticky and highly abrasive grains, which have a habit of clogging instruments and spacesuits. But as Armstrong and Aldrin trotted across the surface, the footprints they left behind gave us valuable information into the properties of moon dust, Flinders University space archaeologist Alice Gorman said. "The ridges on the boots were meant to measure how far they sank into the dust. "Then they used the light contrast between the ridges to measure the reflectance properties of the dust." It's data like this that will help if we want a long-term base on the Moon — we need to know how our gear will stand up to lunar conditions. Apart from the sticky, gritty dust, the lunar surface is also peppered with meteorites and cosmic rays. So, Dr Gorman said, one of the very few reasons to revisit a moon site is to collect some of the equipment left behind and see how it fared. "What has happened to this material in 50 years of sitting on the lunar surface? "This is going to be really interesting scientific information because it will help planning for future missions and get an understanding of long-term conditions." And NASA has already done this. The Apollo 12 mission, which landed on the Moon four months after Apollo 11, collected parts from the 1967 Surveyor probe and brought them back to Earth. Another reason to preserve the equipment left on the Moon is to prove we really went there, Professor Capelotti said. "There's a lot of people out there who still don't believe it happened. "The stuff on the Moon is a testament to what we did and when we did it."

\*\*\*THEIR CARD ENDS\*\*\*

Question of protection Several countries including the US, Russia, China, India and Japan have landed, left and crashed literally tonnes of equipment on the Moon. So, who decides what's worth saving? Space archaeologist Beth O'Leary has grappled with this question since 1999, when a student asked her if preservation of heritage sites, like those on Earth, applied to the Moon. She didn't know, so she checked the 1967 Treaty on Principles Governing the Activities of States on Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies — better known as the Outer Space Treaty. It's the basis of space law and spawned the 1979 Moon Treaty. The Outer Space Treaty states that exploration and use of outer space is to benefit all humanity. This means no-one can lay claim to the Moon itself, but any equipment that ends up on and orbiting the Moon remains the property of the country that put it there. And this raised the question: who protects evidence of humanity's first forays on the dusty lunar surface? "And that's the tricky part. There's nothing about preservation in the treaty. Nobody thought about it at the time," Professor O'Leary said.

### Defense

#### Their 1AC claimed that the aff was key to moon dust research and moon basing couldn’t happen without that research – we’re impact turning that –

#### First, defense --

#### Moon dust doesn’t mess with moon-based observation.

Hamill 16, Patrick. "Atmospheric observations from the moon: A lunar earth-observatory." 2016 Ieee International Geoscience and Remote Sensing Symposium (Igarss). IEEE, 2016. (Department of Physics and Astronomy at San Jose State University) SM

The lunar surface is covered in electrostatically charged fine dust particles of diameter 70 µm. This dust has sharp edges (not having been exposed to weathering) and is expected to cling to surfaces to which it is exposed. It is believed that the dust is disturbed by the changing electric field at the terminator and rises to heights of several meters [9]. This effect may have been observed by the Apollo astronauts. The dust may damage unshielded equipment [10]. Some investigators have even suggested that the presence of dust would make telescopic observations impossible, but the evidence from Chang’e 3 shows that this is not the case. (It might be mentioned that the Chang’e 3 instrumentation is protected during sunrise and sunset.) Furthermore, the retroreflectors placed on the lunar surface by NASA Astronauts and Soviet robotic rovers over forty years ago still reflect laser beams, indicating that even over long periods of time optical surfaces are not completely degraded by the lunar dust [11].

#### But dust definitely still stops moon basing.

Niiler 21 Eric Niiler “The Next Big Challenge for Lunar Astronauts? Moon Dust” 08.19.2021 <https://www.wired.com/story/the-next-big-challenge-for-lunar-astronauts-moon-dust/> SM

AS NASA AND private space companies prepare to send equipment—and eventually astronauts—back to the moon, they are facing a nearly invisible threat to any future lunar outpost: tiny particles of dust. Ground-up lunar rock, known as regolith, clogs drills and other delicate instruments, and it's so sharp that it scratches space suits. Because the dust absorbs sunlight, it can also overheat sensitive electronics.

Dust particles also pose a health risk. Even though Apollo-era astronauts only went outside during a few days on each mission, some reported burning eyes and stuffy nasal passages when they returned from moon walks and took off their dust-covered space suits inside the capsule. Images from the Apollo 17 mission, which focused on geology and featured seven-hour trips in the lunar rover, show astronaut Gene Cernan’s face covered in dust, like some outer space coal miner. During a technical briefing when he returned to Earth, Cernan told NASA officials that lunar dust was nothing to sneeze at. "I think dust is probably one of our greatest inhibitors to a nominal operation on the moon,” Cernan said. “I think we can overcome other physiological or physical or mechanical problems, except dust."

The grit clogged the radiators that removed heat and carbon dioxide from space suits and wore a hole in the knee of Cernan’s outer space suit, according to Phil Abel, who researches moon dust as manager of the Tribology and Mechanical Components Branch at NASA’s Glenn Research Center. (Tribology is the study of wear and friction.) The Apollo 17 astronauts brought dust into the capsule, where it smelled like gunpowder and caused lunar module pilot Harrison Schmitt to have hay fever symptoms, according to a report from a NASA workshop on lunar dust in 2020.

Here’s how one Apollo 12 astronaut described what happened when he returned to the lunar module after a walk on the moon: “The [module] was filthy dirty and had so much dust that when I took my helmet off, I was almost blinded. Junk immediately got into my eyes.” (The quote appears in a 2009 NASA report entitled “The Risk of Adverse Health Effects From Lunar Dust Exposure.”)

Researchers at Stony Brook University exposed human lung and brain cells to lunar dust and found that it killed 90 percent of the cells, according to a study published in the journal GeoHealth in 2018. In fact, respiratory health is a top concern if and when humans return to the moon, according to Abel. “These particles get lodged down deep in your lungs, and that’s a long-term health risk,” Abel says. “There was some concern at the time that if we had needed to do more on the moon’s surface, some of the space suits would have started to leak at too high a rate. It’s something we have been working on to improve.”

#### Not reverse causal – even if we’re aware extreme weather and warming are happening there’s no way to stop it

#### Their ev that lunar observation lets us know when volcanic fumes are high enough to threaten aircraft, not predict when natural disasters occur – this ev is one line and does not grant a more generalized warrant about natural disasters

#### AI prediction methods coming now and solve.

Joshi 19 “How AI Can And Will Predict Disasters” NAVEEN JOSHI [Naveen Joshi, columnist, is Founder and CEO of Allerin, which develops engineering and technology solutions focused on optimal customer experiences. Naveen works in AI, Big Data, IoT and Blockchain.] 3/15/2019 <https://www.forbes.com/sites/cognitiveworld/2019/03/15/how-ai-can-and-will-predict-disasters/?sh=57a309075be2> SM

How AI Can And Will Predict Disasters

Recently, the regions around the Dead Sea in Jordan were flooded, causing the death of 21 children who were on a school trip, and injuring 35 more. Such disasters affect millions of people every year and cause property damage worth hundreds of billions. In 2017 alone, almost 335 natural disasters have affected more than 95.6 million people, and killed 9,697, costing around US $335 billion.

But, the impact of these phenomena can be reduced if we were able to predict their occurrence. AI-powered systems can already predict the prices of stocks, which involve the analysis of numerous variables. Likewise, researchers are applying artificial intelligence to accurately predict natural disasters. By predicting the occurrence of natural disasters, we can save thousands of lives and take appropriate measures to reduce property damage.

Using AI to predict natural disasters

Artificial intelligence has been helping us in various applications such as customer service, trading and healthcare. And now, researchers have found that AI can be used to predict natural disasters. With enormous amounts of good quality datasets, AI can predict the occurrence of numerous natural disasters, which can be the difference between life and death for thousands of people. Some of the natural disasters that can be predicted by AI are:

Earthquakes

Researchers are collecting enormous amounts of seismic data for analysis using deep learning systems. Artificial intelligence can use the seismic data to analyze the magnitude and patterns of earthquakes. Such data can prove beneficial to predict the occurrence of earthquakes. For example, Google and Harvard are developing an AI system that can predict the aftershocks of an earthquake. Scientists have studied more than 131,000 earthquakes and aftershocks to build a neural network. The researchers tested the neural network on 30,000 events, and the system predicted the aftershock locations more precisely when compared to traditional methods.

Similarly, multiple researchers are creating their own applications to predict earthquakes and aftershocks. In the future, we may be able to foresee earthquakes and authorities can start evacuation operations accordingly. Currently, Japan is using satellites to analyze images of the earth to predict natural disasters. AI-based systems look for changes in the images to predict the risk of disasters such as earthquakes and tsunamis. Moreover, these systems also monitor aging infrastructure. Artificial intelligence systems can detect deformations in structures, which can be used to reduce the damage caused by collapsing buildings and bridges, or subsiding roads.

Floods

Google is building an AI platform to predict floods in India and warn users via Google Maps and Google Search. The data for training the AI system is collected with the help of rainfall records and flood simulations. Similarly, researchers are developing AI-based systems that can learn from rainfall and climate records and tested with flood simulations, which can predict floods better than the traditional systems. Alternatively, AI can also be used to monitor urban flooding. Researchers at the University of Dundee in the United Kingdom are monitoring urban flooding by collecting crowd-sourced data with Twitter and other mobile apps. The data contains images and information about the location and situations in a locality, which is recognized by the AI. Such systems can be used to monitor and predict the damage done by floods along with other methods. Likewise, applications based on artificial intelligence and deep learning is useful for disaster management.

Volcanic eruptions

Researchers have always struggled with finding methods to effectively predict natural disasters such as volcanic eruptions. But now, scientists are training AI to recognize tiny ash particles from volcanoes. The shape of the ash particles can be used to identify the type of volcano. Such developments can help in predicting eruptions and creating volcanic hazard mitigation techniques.

IBM is developing Watson that will predict volcanic eruptions using seismic sensors and geological data. IBM is aiming to forecast the locations and the intensity of eruptions with the help of Watson. Such applications can help to prevent the loss of life in areas surrounding active volcanoes.

Hurricanes

Every year hurricanes cost property damage worth millions of dollars. Hence, meteorological departments are looking for better techniques to predict natural disasters like hurricanes and cyclones, and track their path and intensity. With more effective prediction techniques, the concerned authorities can save more lives and reduce property damage.

Recently, NASA and Development Seed tracked Hurricane Harvey using satellite images and machine learning. The method proved to be six times better than the usual techniques, as the hurricane can be tracked every hour instead of every six hours with the traditional methods. Therefore, the developments in technology are helping in monitoring hurricanes and foreseeing the path of hurricanes, which can assist in mitigation efforts.

#### Solves extreme weather predictions specifically.

NERSC 21 “Deep-learning model speeds extreme weather predictions” DECEMBER 8, 2021 National Energy Research Scientific Computing Center [National Energy Research Scientific Computing Center] <https://phys.org/news/2021-12-deep-learning-extreme-weather.html> SM

Deep-learning model speeds extreme weather predictions

A depiction of digital twin Earth adapted from the EU's Destination Earth project.

Climate change is one of the greatest challenges facing humanity today. To help address this, researchers from Lawrence Berkeley National Laboratory (Berkeley Lab), Caltech, and NVIDIA trained the Fourier Neural Operator (FNO) deep learning model—which learns complex physical systems accurately and efficiently—to emulate atmospheric dynamics and provide high-fidelity extreme weather predictions across the globe a full five days in advance.

The researchers used decades of data from ERA5, the European Center for Medium-range Weather Forecasts' high-resolution Earth dataset, to train the FNO model, which was scaled up to 128 NVIDIA A100 GPUs on Perlmutter, the new HPC system at the National Energy Research Scientific Computing Center (NERSC). The team developed a global FNO weather forecasting model at 30-km resolution, an order of magnitude greater resolution than state-of-the-art deep learning Earth emulators. The model predicts wind velocities and pressures at multiple levels in the atmosphere up to 120 hours in advance with high fidelity. In a case study on the massive 2016 hurricane Matthew, the model's predictions of the hurricane's winds and track were within the uncertainties of the NOAA National Hurricane Center's forecast cones. In addition, the model can predict the behavior of certain classes of extreme weather events across the globe days in advance in just 0.25 seconds on a single NVIDIA GPU.

Physics-informed deep learning models such as the FNO offer the potential for accurate predictions of the spatio-temporal evolution of the Earth system orders of magnitude faster than traditional numerical models. This is an ongoing effort, and the team is investigating the comparative accuracy of deep learning and traditional numerical weather models in collaboration with experts in atmospheric modeling and numerical weather prediction.

The FNO model developed through the Berkeley Lab/Caltech/NVIDIA collaboration is a significant step toward building a digital twin Earth, the researchers noted. Digital twin Earths are digital replicas of planet Earth—simulators grounded in physics, driven by AI, and constrained by real-time data. As described in the ambitious 10-year EU project Destination Earth, a digital twin Earth will give both expert and non-expert users tailored access to high-quality information, services, models, forecasts, and visualizations in the realms of climate monitoring, modeling, mitigation, and adaptation. This video shows a demonstration of digital twin Earth using the FNO model.

The FNO climate collaboration was one of several science success stories described by NVIDIA co-founder and CEO Jensen Huang during a keynote presentation at the recent GPU Technology Conference. In his talk, Huang emphasized that the combination of accelerated computing, physics, machine learning, and giant computer systems can provide "a million-x leap" to enable simulating and predicting climate change reliably and accurately.

#### They haven’t read uq ev that natural heritage sites are insufficient now

#### BioD terminal is about GLOBAL biosphere collapsing, not local ecosystems within heritage sites

#### None of their ev is reverse causal or sufficient- it DOES NOT prove that lunar basing ALONE solves all warming adaptation. They cannot fiat that states actually take steps to comply with adaptation recommendations, so assign them zero risk.

#### Warming is not fast and is natural – new research indicates natural cycles exist even when anthropogenic forcing rates are high.

John C. Fyfe et al. March 2016 (Canadian Centre for Climate Modelling and Analysis, Environment and Climate Change Canada, University of Victoria) “Making sense of the early-2000s warming slowdown” (Gerald A. Meehl, Matthew H. England, Michael E. Mann, Benjamin D. Santer, Gregory M. Flato, Ed Hawkins, Nathan P. Gillett, Shang-Ping Xie, Yu Kosaka and Neil C. Swart) www.nature.com/natureclimatechange

Our results support previous findings of a reduced rate of surface warming over the 2001–2014 period — a period in which anthropogenic forcing increased at a relatively constant rate. Recent research that has identified and corrected the errors and inhomogeneities in the surface air temperature record is of high scientific value. Investigations have also identified non-climatic artefacts in tropospheric temperatures inferred from radiosondes and satellites, and important errors in ocean heat uptake estimates. Newly identified observational errors do not, however, negate the existence of a real reduction in the surface warming rate in the early twenty-first century relative to the 1970s–1990s. This reduction arises through the combined effects of internal decadal variability11–18, volcanic19,23 and solar activity, and decadal changes in anthropogenic aerosol forcing32. The warming slowdown has motivated substantial research into decadal climate variability and uncertainties in key external forcings. As a result, the scientific community is now better able to explain temperature variations such as those experienced during the early twenty-first century33, and perhaps even to make skillful predictions of such fluctuations in the future. For example, climate model predictions initialized with recent observations indicate a transition to a positive phase of the IPO with increased rates of global surface temperature warming (ref. 34, and G.A. Meehl, A. Hu and H.Teng, manuscript in preparation).In summary, climate models did not (on average) reproduce the observed temperature trend over the early twenty-first century6, in spite of the continued increase in anthropogenic forcing. This mismatch focused attention on a compelling science problem — a problem deserving of scientific scrutiny. Based on our analysis, which relies on physical understanding of the key processes and forcings involved, we find that the rate of warming over the early twenty-first century is slower than that of the previous few decades. This slowdown is evident in time series of GMST and in the global mean temperature of the lower troposphere. The magnitude and statistical significance of observed trends (and the magnitude and significance of their differences relative to model expectations) depends on the start and end dates of the intervals considered23.Research into the nature and causes of the slowdown has triggered improved understanding of observational biases, radiative forcing and internal variability. This has led to widespread recognition that modulation by internal variability is large enough to produce a significantly reduced rate of surface temperature increase for a decade or even more — particularly if internal variability is augmented by the externally driven cooling caused by a succession of volcanic eruptions. The legacy of this new understanding will certainly outlive the recent warming slowdown. This is particularly true in the embryonic field of decadal climate prediction, where the challenge is to simulate how the combined effects of external forcing and internal variability produce the time-evolving regional climate we will experience over the next ten years35.

#### Warming doesn’t cause extinction- assumes worst case scenarios

Marris, 21 -- institute fellow at UCLA institute of environment and sustainability

[Emma, “We’re Heading Straight for a Demi-Armageddon,” Atlantic, 11-3-21, https://amp.theatlantic.com/amp/article/620605/, accessed 11-5-21]

It is hard to know how to feel. A future of possibly 5 degrees Fahrenheit of warming seems like an unknown country. Is it a civilization-ending crisis? Or is it a more familiar version of awful—a bit sweatier, more chaotic, and less just than the world we currently inhabit?

[Brian O’Neill](https://www.pnnl.gov/news-media/brian-oneill-named-new-director-joint-global-change-research-institute), the director of the Joint Global Change Research Institute, a partnership between the U.S. Department of Energy and the University of Maryland at College Park, has a clearer view of this question than most of us. He was one of the lead architects of the five different futures—called “shared socioeconomic pathways,” or SSPs—[developed for the latest IPCC report](https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf).

These five futures aren’t just versions of 2100 at different temperatures. [Each started with a different idea about how society might develop](https://www.researchgate.net/profile/Marc-Levy-7/publication/272423967_The_roads_ahead_Narratives_for_shared_socioeconomic_pathways_describing_world_futures_in_the_21st_century/links/5e7dd26f458515efa0adb82b/The-roads-ahead-Narratives-for-shared-socioeconomic-pathways-describing-world-futures-in-the-21st-century.pdf). The SSP 1 pathway, which keeps us under that 1.5-degree-Celsius goal, for example, is the “Sustainability” path. In this scenario, the global economy still expands, but humanity “shifts toward a broader emphasis on human well-being, even at the expense of somewhat slower economic growth over the longer term.” The highest-temperature scenarios are SSP 4, in which inequality accelerates to even more grotesque levels, but advanced technology zaps some emissions, and SSP 5, where the world simply charges forward with fossil-fuel-powered turbo-capitalism.

The path we seem to be on, at least for now, looks closer to SSP 2, which the authors call “Middle of the Road.” This is a world in which “social, economic, and technological trends do not shift markedly from historical patterns.” A world, in other words, in which we do not heroically rise to the occasion to fix things, but in which we also don’t get much worse than we already are.

So what does this SSP 2 world feel like? It depends, O’Neill told me, on who you are. One thing he wants to make very clear is that all the paths, even the hottest ones, show improvements in human well-being on average. IPCC scientists expect that average life expectancy will continue to rise, that poverty and hunger rates will continue to decline, and that average incomes will go up in every single plausible future, simply because they always have. “There isn’t, you know, like a *Mad Max* scenario among the SSPs,” O’Neill said. Climate change will ruin individual lives and kill individual people, and it may even drag down rates of improvement in human well-being, but on average, he said, “we’re generally in the climate-change field not talking about futures that are worse than today.”

But all the current physical impacts of climate change—drought, extreme heat, fire, storms, sea-level rise—would get [significantly worse](https://interactive.carbonbrief.org/impacts-climate-change-one-point-five-degrees-two-degrees/?utm_source=web&utm_campaign=Redirect) by 2100 under SSP 2. And say goodbye to coral reefs. “At 2.5 degrees [Celsius], it’s probably a world in which we don’t have them,” O’Neill said. “They don’t exist.” The Arctic? “My guess is that we would have a permanently ice-free Arctic in the summer. And so we would have all of the ecological consequences that would come along with that.”

All the IPCC scenarios might be wrong. They’re using statistical extrapolation and models, and as O’Neill reminded me, history is always wilder than people expect. (Just as *Mad Max* scenarios are missing from the SSPs, so are “[no growth](https://www.boell.de/sites/default/files/endf2_kuhnhenn_growth_in_mitigation_scenarios.pdf)” scenarios.) But the world we are heading toward may be one in which the average human is living longer and making more money than ever, but some vulnerable humans and many nonhumans are collateral damage.

This is why many climate activists frame global warming as a problem of justice.

#### Warming isn’t existential- their ev is alarmist and not supported by robust science

Shellenberger, 19 -- Founder and President of Environmental Progress

[Michael, best-selling author of Apocalypse Never: Why Environmental Alarmism Hurts Us All, "Why Apocalyptic Claims About Climate Change Are Wrong," Forbes, 11-25-19, https://www.forbes.com/sites/michaelshellenberger/2019/11/25/why-everything-they-say-about-climate-change-is-wrong/?sh=a388b7712d6a, accessed 11-20-20]

Environmental journalists and advocates have in recent weeks made a number of apocalyptic predictions about the impact of climate change. Bill McKibben suggested climate-driven fires in Australia had made koalas “functionally extinct.” Extinction Rebellion said “Billions will die” and “Life on Earth is dying.” Vice claimed the “collapse of civilization may have already begun.” Few have underscored the threat more than student climate activist Greta Thunberg and Green New Deal sponsor Rep. Alexandria Ocasio-Cortez. The latter said, “The world is going to end in 12 years if we don't address climate change.” Says Thunberg in her new book, “Around 2030 we will be in a position to set off an irreversible chain reaction beyond human control that will lead to the end of our civilization as we know it.” Sometimes, scientists themselves make apocalyptic claims. “It’s difficult to see how we could accommodate a billion people or even half of that,” if Earth warms four degrees, said one earlier this year. “The potential for multi-breadbasket failure is increasing,” said another. If sea levels rise as much as the Intergovernmental Panel on Climate Change predicts, another scientist said, “It will be an unmanageable problem.” Apocalyptic statements like these have real-world impacts. In September, a group of British psychologists said children are increasingly suffering from anxiety from the frightening discourse around climate change. In October, an activist with Extinction Rebellion (”XR”) — an environmental group founded in 2018 to commit civil disobedience to draw awareness to the threat its founders and supporters say climate change poses to human existence — and a videographer, were kicked and beaten in a London Tube station by angry commuters. And last week, an XR co-founder said a genocide like the Holocaust was “happening again, on a far greater scale, and in plain sight” from climate change. Climate change is an issue I care passionately about and have dedicated a significant portion of my life to addressing. I have been politically active on the issue for over 20 years and have researched and written about it for 17 years. Over the last four years, my organization, Environmental Progress, has worked with some of the world’s leading climate scientists to prevent carbon emissions from rising. So far, we’ve helped prevent emissions increasing the equivalent of adding 24 million cars to the road. I also care about getting the facts and science right and have in recent months corrected inaccurate and apocalyptic news media coverage of fires in the Amazon and fires in California, both of which have been improperly presented as resulting primarily from climate change. Journalists and activists alike have an obligation to describe environmental problems honestly and accurately, even if they fear doing so will reduce their news value or salience with the public. There is good evidence that the catastrophist framing of climate change is self-defeating because it alienates and polarizes many people. And exaggerating climate change risks distracting us from other important issues including ones we might have more near-term control over. I feel the need to say this up-front because I want the issues I’m about to raise to be taken seriously and not dismissed by those who label as “climate deniers” or “climate delayers” anyone who pushes back against exaggeration. With that out of the way, let’s look whether the science supports what’s being said. First, no credible scientific body has ever said climate change threatens the collapse of civilization much less the extinction of the human species. “‘Our children are going to die in the next 10 to 20 years.’ What’s the scientific basis for these claims?” BBC’s Andrew Neil asked a visibly uncomfortable XR spokesperson last month. “These claims have been disputed, admittedly,” she said. “There are some scientists who are agreeing and some who are saying it’s not true. But the overall issue is that these deaths are going to happen.” “But most scientists don’t agree with this,” said Neil. “I looked through IPCC reports and see no reference to billions of people going to die, or children in 20 years. How would they die?” “Mass migration around the world already taking place due to prolonged drought in countries, particularly in South Asia. There are wildfires in Indonesia, the Amazon rainforest, Siberia, the Arctic,” she said. But in saying so, the XR spokesperson had grossly misrepresented the science. “There is robust evidence of disasters displacing people worldwide,” notes IPCC, “but limited evidence that climate change or sea-level rise is the direct cause” What about “mass migration”? “The majority of resultant population movements tend to occur within the borders of affected countries," says IPCC. It’s not like climate doesn’t matter. It’s that climate change is outweighed by other factors. Earlier this year, researchers found that climate “has affected organized armed conflict within countries. However, other drivers, such as low socioeconomic development and low capabilities of the state, are judged to be substantially more influential.” Last January, after climate scientists criticized Rep. Ocasio-Cortez for saying the world would end in 12 years, her spokesperson said "We can quibble about the phraseology, whether it's existential or cataclysmic.” He added, “We're seeing lots of [climate change-related] problems that are already impacting lives." That last part may be true, but it’s also true that economic development has made us less vulnerable, which is why there was a 99.7% decline in the death toll from natural disasters since its peak in 1931. In 1931, 3.7 million people died from natural disasters. In 2018, just 11,000 did. And that decline occurred over a period when the global population quadrupled. What about sea level rise? IPCC estimates sea level could rise two feet (0.6 meters) by 2100. Does that sound apocalyptic or even “unmanageable”? Consider that one-third of the Netherlands is below sea level, and some areas are seven meters below sea level. You might object that Netherlands is rich while Bangladesh is poor. But the Netherlands adapted to living below sea level 400 years ago. Technology has improved a bit since then. What about claims of crop failure, famine, and mass death? That’s science fiction, not science. Humans today produce enough food for 10 billion people, or 25% more than we need, and scientific bodies predict increases in that share, not declines. The United Nations Food and Agriculture Organization (FAO) forecasts crop yields increasing 30% by 2050. And the poorest parts of the world, like sub-Saharan Africa, are expected to see increases of 80 to 90%. Nobody is suggesting climate change won’t negatively impact crop yields. It could. But such declines should be put in perspective. Wheat yields increased 100 to 300% around the world since the 1960s, while a study of 30 models found that yields would decline by 6% for every one degree Celsius increase in temperature. Rates of future yield growth depend far more on whether poor nations get access to tractors, irrigation, and fertilizer than on climate change, says FAO. All of this helps explain why IPCC anticipates climate change will have a modest impact on economic growth. By 2100, IPCC projects the global economy will be 300 to 500% larger than it is today. Both IPCC and the Nobel-winning Yale economist, William Nordhaus, predict that warming of 2.5°C and 4°C would reduce gross domestic product (GDP) by 2% and 5% over that same period. Does this mean we shouldn’t worry about climate change? Not at all. One of the reasons I work on climate change is because I worry about the impact it could have on endangered species. Climate change may threaten one million species globally and half of all mammals, reptiles, and amphibians in diverse places like the Albertine Rift in central Africa, home to the endangered mountain gorilla. But it’s not the case that “we’re putting our own survival in danger” through extinctions, as Elizabeth Kolbert claimed in her book, Sixth Extinction. As tragic as animal extinctions are, they do not threaten human civilization. If we want to save endangered species, we need to do so because we care about wildlife for spiritual, ethical, or aesthetic reasons, not survival ones. And exaggerating the risk, and suggesting climate change is more important than things like habitat destruction, are counterproductive. For example, Australia’s fires are not driving koalas extinct, as Bill McKibben suggested. The main scientific body that tracks the species, the International Union for the Conservation of Nature, or IUCN, labels the koala “vulnerable,” which is one level less threatened than “endangered,” two levels less than “critically endangered,” and three less than “extinct” in the wild. Should we worry about koalas? Absolutely! They are amazing animals and their numbers have declined to around 300,000. But they face far bigger threats such as the destruction of habitat, disease, bushfires, and invasive species. Think of it this way. The climate could change dramatically — and we could still save koalas. Conversely, the climate could change only modestly — and koalas could still go extinct. The monomaniacal focus on climate distracts our attention from other threats to koalas and opportunities for protecting them, like protecting and expanding their habitat. As for fire, one of Australia’s leading scientists on the issue says, “Bushfire losses can be explained by the increasing exposure of dwellings to fire-prone bushlands. No other influences need be invoked. So even if climate change had played some small role in modulating recent bushfires, and we cannot rule this out, any such effects on risk to property are clearly swamped by the changes in exposure.” Nor are the fires solely due to drought, which is common in Australia, and exceptional this year. “Climate change is playing its role here,” said Richard Thornton of the Bushfire and Natural Hazards Cooperative Research Centre in Australia, “but it's not the cause of these fires." The same is true for fires in the United States. In 2017, scientists modeled 37 different regions and found “humans may not only influence fire regimes but their presence can actually override, or swamp out, the effects of climate.” Of the 10 variables that influence fire, “none were as significant… as the anthropogenic variables,” such as building homes near, and managing fires and wood fuel growth within, forests. Climate scientists are starting to push back against exaggerations by activists, journalists, and other scientists. “While many species are threatened with extinction,” said Stanford’s Ken Caldeira, “climate change does not threaten human extinction... I would not like to see us motivating people to do the right thing by making them believe something that is false.” I asked the Australian climate scientist Tom Wigley what he thought of the claim that climate change threatens civilization. “It really does bother me because it’s wrong,” he said. “All these young people have been misinformed. And partly it’s Greta Thunberg’s fault. Not deliberately. But she’s wrong.” But don’t scientists and activists need to exaggerate in order to get the public’s attention? “I’m reminded of what [late Stanford University climate scientist] Steve Schneider used to say,” Wigley replied. “He used to say that as a scientist, we shouldn’t really be concerned about the way we slant things in communicating with people out on the street who might need a little push in a certain direction to realize that this is a serious problem. Steve didn’t have any qualms about speaking in that biased way. I don’t quite agree with that.” Wigley started working on climate science full-time in 1975 and created one of the first climate models (MAGICC) in 1987. It remains one of the main climate models in use today. “When I talk to the general public,” he said, “I point out some of the things that might make projections of warming less and the things that might make them more. I always try to present both sides.” Part of what bothers me about the apocalyptic rhetoric by climate activists is that it is often accompanied by demands that poor nations be denied the cheap sources of energy they need to develop. I have found that many scientists share my concerns. “If you want to minimize carbon dioxide in the atmosphere in 2070 you might want to accelerate the burning of coal in India today,” MIT climate scientist Kerry Emanuel said. “It doesn’t sound like it makes sense. Coal is terrible for carbon. But it’s by burning a lot of coal that they make themselves wealthier, and by making themselves wealthier they have fewer children, and you don’t have as many people burning carbon, you might be better off in 2070.” Emanuel and Wigley say the extreme rhetoric is making political agreement on climate change harder. “You’ve got to come up with some kind of middle ground where you do reasonable things to mitigate the risk and try at the same time to lift people out of poverty and make them more resilient,” said Emanuel. “We shouldn’t be forced to choose between lifting people out of poverty and doing something for the climate.” Happily, there is a plenty of middle ground between climate apocalypse and climate denial.

### Offense

#### 1]Lunar basing causes collisions and space junk – independently turns the aff.

Mann 13 “Space: The Final Frontier of Environmental Disasters?” Adam Mann 7/15/2013 <https://www.wired.com/2013/07/space-environmentalism/> SM

Commercial or scientific bases on the lunar surface will need satellites for communication and navigation. Because of the moon’s size and mass, there aren’t stable orbits that hover above a certain spot analogous to the geostationary orbits around Earth. In order to provide a continuous link or GPS-like triangulation, there will need to be a constellation of satellites around the moon. Multiple satellites with multiple operators increase the chance of collision.

Unlike our planet, the moon lacks an atmosphere and it isn’t covered in oceans. This means that nothing can burn up and there’s no good way to dispose of dead satellites. The atmospheric friction that naturally drags down objects around Earth doesn't exist around the moon. And anything that is commanded to fall down to the lunar surface will remain intact until it impacts the ground, potentially hitting an astronaut or Apollo-era artifact. Mars, with its very thin atmosphere, could have similar problems with orbital debris. If nothing is done, space junk might be exported beyond low-Earth orbit, potentially endangering our exploration of other worlds.

#### Collisions cause miscalc and go nuclear.

Blatt 20 [Talia, joint concentration in Social Studies and Integrative Biology at Harvard, specialization in East Asian geopolitics and security issues] “Anti-Satellite Weapons and the Emerging Space Arms Race,” Harvard International Review, May 26, 2020, <https://hir.harvard.edu/anti-satellite-weapons-and-the-emerging-space-arms-race/> TG

Despite their deterrent functions, ASATs are more likely to provoke or exacerbate conflicts than dampen them, especially given the risk they [pose](https://thebulletin.org/2019/06/arms-control-in-outer-space-the-russian-angle-and-a-possible-way-forward/) to early warning satellites. These satellites are a crucial element of US ballistic missile defense, capable of [detecting missiles](https://www.globalsecurity.org/space/world/japan/warning.htm) immediately after launch and tracking their paths.

Suppose a US early warning satellite goes dark, or is shut down. Going dark could signal a glitch, but in a world in which other countries have ASATs, it could also signal the beginning of an attack. Without early warning satellites, the United States is much more susceptible to nuclear missiles. Given the strategy of counterforcing—[targeting](https://www.belfercenter.org/sites/default/files/files/publication/isec_a_00273_LieberPress.pdf) nuclear silos rather than populous cities to prevent a nuclear counterattack—the Americans might believe their nuclear weapons are imminently at risk. It could be [twelve hours](https://books.google.com/books?id=ET8lDwAAQBAJ&pg=PA1&lpg=PA1&dq=%22Protecting+Space+Assets%22+johnson-freese&source=bl&ots=6Oq0IdeBjw&sig=ACfU3U1G6Hj8QdP4JlCRNxA6i5XplZwHyg&hl=en&sa=X&ved=2ahUKEwj1n-jT2YzpAhUugnIEHUuMCu4Q6AEwA3oECAkQAQ#v=onepage&q=%22Protecting%20Space%20Assets%22%20johnson-freese&f=false) before the United States regains satellite function, which is too long to wait to put together a nuclear counterattack. The United States, therefore, might move to mobilize a nuclear attack against Russia or China over what might just be a piece of debris shutting off a satellite.

Additionally, accidental warfare, or strategic miscalculation, is uniquely likely in space. It is [much easier](https://books.google.com/books?id=VyXTDwAAQBAJ&pg=PA339&lpg=PA339&dq=space+offense+dominant&source=bl&ots=Mw0bgJ51qf&sig=ACfU3U3DeZiEHpr9nfszlCbJZIoyyssIpg&hl=en&sa=X&ved=2ahUKEwjrs-WD3IzpAhVulHIEHbL0AE4Q6AEwCXoECAoQAQ#v=onepage&q=space%20offense%20dominant&f=false) to hold an adversary’s space systems in jeopardy with destructive ASATs than it is to [sustainably defend](https://www.cnas.org/publications/commentary/the-us-military-should-not-be-doubling-down-on-space) a system, which is expensive and in some cases not technologically feasible because of limitations on satellite movement. Space is therefore [considered](https://books.google.com/books?id=VyXTDwAAQBAJ&pg=PA339&lpg=PA339&dq=space+offense+dominant&source=bl&ots=Mw0bgJ51qf&sig=ACfU3U3DeZiEHpr9nfszlCbJZIoyyssIpg&hl=en&sa=X&ved=2ahUKEwjrs-WD3IzpAhVulHIEHbL0AE4Q6AEwCXoECAoQAQ#v=onepage&q=space%20offense%20dominant&f=false) offense-dominant; offensive tactics like weapons development are prioritized over defensive measures, such as [improving GPS](https://www.politico.com/story/2018/04/06/outer-space-war-defense-russia-china-463067) or making satellites more resistant to jamming.

As a result, countries are left with poorly defended space systems and rely on offensive posturing, which increases the risk that their actions are perceived as aggressive and incentivizes rapid, risky counterattacks because militaries cannot rely on their spaced-based systems after first strikes.

There are several hotspots in which ASATs and offensive-dominant systems are particularly relevant. Early warning satellites [play](https://www.politico.com/story/2018/04/06/outer-space-war-defense-russia-china-463067) a central role in US readiness in the event of a conflict involving North Korea. News of North Korean missile launches comes from these satellites. Given North Korea’s [history](https://www.bbc.com/news/world-asia-pacific-11813699) of nuclear provocations, unflinchingly hostile rhetoric towards the United States and South Korea, and diplomatic opacity, North Korea is always a threatening, unknowable adversary, but recent developments have magnified the risk. With the health of Kim Jong-un [potentially in jeopardy](https://apnews.com/f5d302ae65b03838173e40848223b771), a succession battle or even civil war on the peninsula [raises the chances](https://www.express.co.uk/news/world/1273890/Kim-Jong-un-dead-North-Korea-nuclear-weapon-news-latest-death-US) of loose nukes. If the regime is terminal, traditional MAD risk calculus will become moot; with nothing to lose, North Korea would have no reason to hold back its nuclear arsenal. Or China [might decide](https://foreignpolicy.com/2020/04/28/kim-jong-un-china-north-korea/) to seize military assets and infrastructure of the regime. If the US does not have its early warning satellites because they have been taken out in an ASAT attack, the US, South Korea, and Japan are all in imminent nuclear peril, while China could be in a position to fundamentally reshape East Asian geopolitics.

The South China Sea is another hotspot in which ASATs could risk escalation. China [is developing](https://missiledefenseadvocacy.org/missile-threat-and-proliferation/todays-missile-threat/china-anti-access-area-denial-coming-soon/) Anti-Access Area Denial (A2/AD) in the South China Sea, a combination of long range radar with air and maritime defense meant to deny US freedom of navigation in the region. Given the disputed nature of territory in the South China Sea, the United States and its allies do not want China to successfully close off the region.

#### 2] Moon basing causes US-China war due to competing property claims

Copp 21 If China and the US Claim the Same Moon-Base Site, Who Wins? TARA COPP [SENIOR PENTAGON REPORTER, DEFENSE ONE] AUGUST 8, 2021 <https://www.defenseone.com/technology/2021/08/if-china-and-us-claim-same-moon-base-site-who-wins/184352/> SM

If China and the US Claim the Same Moon-Base Site, Who Wins?

Relatively few craters are attractive, and there’s no consensus about avoiding conflict over them.

There’s a not-so-quiet race back to the moon underway, but the two largest factions, with China and Russia on one side, and the United States and its partners on the other, are not recognizing each others’ proposed rules on what’s allowed once they get there.

Lawmakers and space policy analysts are concerned: How do you avoid conflict in space if the international laws and policies on Earth no longer apply?

“Many terrestrial military doctrines are not applicable in space, or at least not as applicable. If you get beyond 50 miles, or at least 62 miles, suddenly different rules apply. We need to start being aware of that,” says Rep. Jim Cooper, D-Tenn.

There’s already some aggressive international elbowing over the rules of satellite operations. As with the moon, there’s no consensus yet on how to respond to aggression in Earth orbit, the head of U.S. Space Command Gen. James Dickinson told attendees at last week’s Sea Air Space conference.

“The behavior of some of our adversaries in space may surprise you,” Dickinson said. “If similar actions have been taken in other domains, they'd likely be considered provocative, aggressive, or maybe even irresponsible. And in response, the U.S. government would take corresponding actions using all levers of national power, a demarche, or a sanction or something to indicate we won't tolerate that type of behavior, but we're not quite there yet in space policy.”

In 1967, the U.N. General Assembly adopted a treaty on the use of outer space that promised cooperation and banned nuclear weapons, military maneuvers, and military installations off-planet. The agreement also requires countries to take “appropriate international consultations” before making any moves that would “cause potentially harmful interference” with other space programs, and allows countries to “request consultation” if they believe such interference is likely.

This treaty “forecasted very well” the issues that that might arise as space exploration expanded, said James Lake, a senior associate at Canyon Consulting who co-wrote an article on lunar security issues in this month’s Space Force Journal. “The question remains: is that text sufficient? That’s something we are going to find out fairly soon.”

Notably, a treaty annex that prohibits military activity on the moon went unratified by Russia, China, and the United States. It’s likely both the China-Russia and U.S.-led partnerships will begin their moon bases without any sort of agreement between them in place.

In June, the China National Space Agency and Russia’s Roscosmos announced they would begin surveying locations for their International Lunar Research Station this year, and pick a site by 2025.

In 2020, NASA, together with the nations partnering with the U.S. under the Artemis Accords, outlined its Artemis Base Camp project. The Artemis nations aim to to send astronauts back to the moon by 2024.

In addition to those two major alliances, private firms such as Blue Origin are also working on private moon bases.

But there may be only a few locations on the moon where it would make economic sense to build a base, said Bleddyn Bowen, a professor at the University of Leicester and author of War in Space: Strategy, Spacepower, Geopolitics.

“Water ice, for example, might be in limited pockets, for example, making the territories around certain craters on the polar regions, perhaps more desirable,” Bowen said.

So what happens if each decides on the same crater as the best spot to begin moon operations?

“If you have a situation like that, where you're trying to do something in the exact same spot, it’s essentially who gets there first,” said Alex Gilbert, a researcher and space resources doctoral student at the Payne Institute at the Colorado School of Mines. “And if you're not first, then the only alternative is to forcibly remove the current occupant.”

The Artemis nations have endorsed the idea of “safety zones” on the moon, to require communication between two space operations that want to operate in the same area.

“Even if you set up a base and you declare a safety zone, people can still go into that safety zone. It's just something that it's really to be used as a tool to get parties to talk to each other,” he said.

But there’s already a risk those zones will instead be used as a way to rope off sites from competitors, he said.

“One thing that is really kind of important to understand about safety zones is that everyone kind of has their own definition,” Gilbert said.

“Whoever gets there first can use the resources, but no nation can ‘claim’ the territory,” said Laura Duffy, a space systems engineer with Canyon Consulting who co-wrote “Cislunar Spacepower, The New Frontier,” with Lake with Lake in this month’s Space Force Journal.

It’s not just water, but rare earth metals and helium-3 that will be up for grabs on the moon, making a treaty for its peaceful use critical, Duffy said.

“The Moon must be available for open and free use, according to the Artemis Accords and Outer Space Treaty,” she said.

But neither Russia nor China are expected to join the Artemis Accords.

Until now, U.S. space defense has largely concentrated around the objects orbiting Earth. That changed this year, when the U.S. Space Force and U.S. Space Command were tasked with protecting U.S. assets up to 272,000 miles away, a volume called “cislunar space” that extends slightly beyond the Moon’s orbit.

They have some catching up to do, said Rep. Frank Lucas, R-Okla., the ranking member of the Science, Space and Technology Committee. Lucas believes the 2019 landing of China’s Chang'e-4 spacecraft on the far side of the moon should have been this generation’s Sputnik moment.

“But with all of the chaos in the world, and COVID-19, and all of this environment we're working in, we missed it,” he said.

Those far-side moon operations meant China had developed the technology to operate and communicate with its landed rover out of line of sight—and out of view of almost all of the U.S. ability to see what they’re doing.

The achievement allows China “to accomplish scientific, military, or other endeavors without observation or repercussion,” Duffy and Lake wrote. The authors urged that the U.S. needs to speed its monitoring efforts, such as the Cislunar Highway Patrol System, or CHPS, that is being developed by the Air Force Research Laboratory.

#### US-China war goes nuclear

Talmadge 18, Caitlin [**PoliSci PhD from MIT**, Government BA from Harvard, Prof of Security Studies at Georgetown’s Walsh School of Foreign Service.] “Beijing’s Nuclear Option.” Foreign Affairs. October 15, 2018. <https://www.foreignaffairs.com/articles/china/2018-10-15/beijings-nuclear-option> TG

As China’s power has grown in recent years, so, too, has the risk of war with the United States. Under President Xi Jinping, China has increased its political and economic pressure on Taiwan and built military installations on coral reefs in the South China Sea, fueling Washington’s fears that Chinese expansionism will threaten U.S. allies and influence in the region. U.S. destroyers have transited the Taiwan Strait, to loud protests from Beijing. American policymakers have wondered aloud whether they should send an aircraft carrier through the strait as well. Chinese fighter jets have intercepted U.S. aircraft in the skies above the South China Sea. Meanwhile, U.S. President Donald Trump has brought long-simmering economic disputes to a rolling boil.

A war between the two countries remains unlikely, but the prospect of a military confrontation—resulting, for example, from a Chinese campaign against Taiwan—no longer seems as implausible as it once did. And the odds of such a confrontation going nuclear are higher than most policymakers and analysts think.

Members of China’s strategic com­munity tend to dismiss such concerns. Likewise, U.S. studies of a potential war with China often exclude nuclear weapons from the analysis entirely, treating them as basically irrelevant to the course of a conflict. Asked about the issue in 2015, Dennis Blair, the former commander of U.S. forces in the Indo-Pacific, estimated the likelihood of a U.S.-Chinese nuclear crisis as “somewhere between nil and zero.”

This assurance is misguided. If deployed against China, the Pentagon’s preferred style of conventional warfare would be a potential recipe for nuclear escalation. Since the end of the Cold War, the United States’ signature approach to war has been simple: punch deep into enemy territory in order to rapidly knock out the opponent’s key military assets at minimal cost. But the Pentagon developed this formula in wars against Afghanistan, Iraq, Libya, and Serbia, none of which was a nuclear power.

China, by contrast, not only has nuclear weapons; it has also intermingled them with its conventional military forces, making it difficult to attack one without attacking the other. This means that a major U.S. military campaign targeting China’s conventional forces would likely also threaten its nuclear arsenal. Faced with such a threat, Chinese leaders could decide to use their nuclear weapons while they were still able to.

As U.S. and Chinese leaders navigate a relationship fraught with mutual suspicion, they must come to grips with the fact that a conventional war could skid into a nuclear confrontation. Although this risk is not high in absolute terms, its consequences for the region and the world would be devastating. As long as the United States and China continue to pursue their current grand strategies, the risk is likely to endure. This means that leaders on both sides should dispense with the illusion that they can easily fight a limited war. They should focus instead on managing or resolving the political, economic, and military tensions that might lead to a conflict in the first place.

#### AC Hertzfeld and Pace doesn’t get them out of the impact turn – it says countries have no incentive to infringe upon foreign heritage sites BUT that doesn’t speak to contestation over more desirable regions on the remaining 99% of the moon

#### Unknown legal thresholds make inadvertent space escalation highly likely

MacDonald ’18 – senior director of the Nonproliferation and Arms Control Project with the Center for Conflict Analysis and Prevention, Adjunct Lecturer at Johns Hopkins School of Advanced International Studies. Bruce MacDonald, “Chapter 2. Space and Escalation” in *Outer Space; Earthly Escalation? Chinese Perspectives on Space Operations and Escalation*, A Strategic Multilayer Assessment (SMA) Periodic Publication, August 2018, <https://nsiteam.com/social/wp-content/uploads/2018/08/SMA-White-Paper_Chinese-Persepectives-on-Space_-Aug-2018.pdf>

Another dimension of the problem is the issue of the scale of the attack, both qualitatively and quantitatively. While jamming one or two satellites in isolation appears unlikely to quickly escalate into all-out space war (given the longstanding role of electronic warfare in past conflicts), attacking multiple intelligence-gathering satellites would carry a far higher risk of escalation. Somewhere between these two extremes, however, is an uncertain and unknowable boundary that divides offensive space actions that modestly threaten stability from those that are clearly destabilizing and escalatory. In this unpredictable environment, a country with no desire to spark an all-out space war may still prompt rapid escalation with modest offensive actions that inadvertently cross an unknown threshold. In addition, for technological, commercial, and other reasons the space and cyber domains are evolving far more rapidly than the conventional and nuclear domains, potentially rendering space and cyber strategies ineffective or irrelevant within a few years. In both space and cyberspace, we may learn firsthand how much escalation is too much only after it is too late to stop. Evolving space dynamics could undermine whatever current understanding we may have of crisis and strategic stability in space, and this imperfect grasp of general principles can only add to our uncertainty about the space and cyber offensive capabilities of particular adversaries. Therefore, uncertainty, bluffs, and worst-case thinking are bound to remain prominent forces in the strategic landscape of space. For example, rendezvous and proximity operations on satellites will become more common in the years to come, but they could easily be viewed in a crisis as potentially hostile acts—or in fact be used to commit hostile acts.

#### 4] Moon basing key to China-Russia counterbalancing – guts US space dominance.

Goswami 21 “The Strategic Implications of the China-Russia Lunar Base Cooperation Agreement” [Dr. Namrata Goswami is an independent scholar on space policy, great power politics, and ethnic conflicts.] March 19, 2021 <https://thediplomat.com/2021/03/the-strategic-implications-of-the-china-russia-lunar-base-cooperation-agreement/> SM

The Strategic Implications of the China-Russia Lunar Base Cooperation Agreement

With their agreement, the partners are signalling an alternative to a U.S.-led order in space.

On March 9, 2021, the China National Space Administration (CNSA) and Russian Space Agency (ROSCOSMOS) signed a Memorandum of Understanding (MoU) for the joint construction of an autonomous lunar permanent research base. Employing the language of the Outer Space Treaty of 1967, China and Russia emphasized that the MoU is about scientific discovery as well as the use of lunar terrain. The agreement describes the planned International Lunar Research Station (ILRS) as “a comprehensive scientific experiment base with the capability of long-term autonomous operations, built on the lunar surface and/or on the lunar orbit that will carry out multi-disciplinary and multi-objective scientific research activities such as the lunar exploration and utilization, lunar-based observation, basic scientific experiment, and technical verification.”

These two major space faring nations have agreed to promote the ILRS to gain international partners for their joint lunar mission, especially by broadcasting China’s lunar South Pole environment and resource survey mission, the Chang’e 7 and Russia’s Luna-Resurs-1 Russian Orbital Spacecraft (OS) Mission.

That China and Russia would cooperate on exploration and utilization of lunar resources comes as no surprise. Both countries, especially Russia, keenly watched as the United States announced the Artemis Accords for creating an international mechanism for lunar development led by the U.S. and partner nations. ROSCOSMOS, in reaction to the Artemis Accords and especially former President Donald Trump’s April 6, 2020 executive order on the utilization of space resources for international partnerships stated, via its deputy director for international cooperation, Sergei Savelyev, that “attempts to expropriate outer space and aggressive plans to actually take over other planets” go against the principle of international cooperation. The Kremlin likened Trump’s executive order to the colonization of space, with Kremlin spokesman Dmitry Peskov coming out strong, stating that it would be “unacceptable” for the U.S. to privatize and colonize space.

While China officially did not respond to the Artemis Accords, the CNSA’s Space Law Center Deputy Director Guoyu Wang argued in an article in The Space Review that the accords cannot be viewed as an extension of the OST, but are instead an attempt to create norms outside of established international regulatory frameworks.

The Moon Is Strategic

The moon is no longer seen as a dead rock where humanity lands for a few days, shows off technology, and then journeys back to Earth. Today the discourse on the moon is about its resource potential, including the presence of water ice, solar power, and rare earth elements like platinum, titanium, scandium, and yttrium. Chinese space scientists and engineers have long recognized the economic potential of space resources to include a $10 trillion return on investments from the Earth-moon zone annually by 2050.

All the way back in 2002, Ouyang Ziyuan, lead scientist and founder of China Lunar Exploration Program (CLEP) specified that “China’s long-term aim and task is to set up a base on the moon to tap and make use of its rich resources.” His perspective was supported at the highest level of CNSA leadership. China’s subsequent demonstrations of lunar capacity include a far side lunar landing in 2019 and an autonomous lunar sample return mission in 2020.

Other benefits highlighted by Chinese scientists are the potential of lunar propellant made from water-ice lowering the cost of access and movement throughout the entire volume of cislunar space. Launching from the moon is 22 times more efficient than launching from Earth due to Earth’s gravity well. In order to access those lunar resources, a long-term permanent presence, first robotic, then human, will be necessary. This aspect of first mastering autonomous robotic lunar basing capacities is highlighted in the China-Russia MoU.

Similar to China’s long-term plans for a permanent presence on the moon and a lunar research base by 2036, Russia in 2018 announced its own lunar plan, which included resource extraction ambitions, backed by a three phase base construction plan between 2025 and 2040. The first stage is a lunar orbiter module (2025); the second phase will be the construction of a lunar base (2025-2034); and the third phase (2040) will involve the construction of an “integrated manned moon exploration system.” The former chief designer of Russia’s manned space programs, the late Yevgeny Mikrin, in an interview with state run RIA Novosti news in November 2018, specified that the construction of the moon colony was to begin in 2025.

The strategic recognition of the critical role of the Earth-moon economic zone for future space development and utilization is the first peg on which the China-Russia MoU stands. Besides that, there are two other specific geopolitical and regime constriction considerations at play here.

Geopolitical Considerations

The future of space is its economy, with possible returns in the trillions of dollars. And robust economic growth leads to military and other power projection capacities. Both China and Russia understand the impact of space on the future of global leadership. China wants to become the foremost space power by 2045, in time for the centenary of the establishment of the People’s Republic in 2049. President Xi Jinping has repeatedly highlighted the intrinsic contribution of space to Chinese global leadership. The idea behind China’s space philosophy is to demonstrate high-end technology, including human missions, lunar soft landings (near and far side), lunar sample returns, and Mars missions, to be followed by construction of a permanent space station, space-based solar power satellites, and deep space probes.

For China, the MoU with Russia came at the appropriate geopolitical moment, especially after it has successfully demonstrated high end indigenous space capacity like lunar far side landing, autonomous lunar sample return, and a Mars mission. China no longer has to worry about the age-old cliché that all Chinese space technology is reengineered Russian space technology.

For Russia, joining in with China’s lunar base goal, even as a junior partner, means that the two nations can pool their joint international resources to register opposition to a U.S.-led space order, something both sides are uncomfortable with. For Russia and especially President Vladimir Putin, it is about taking back the space leadership position it enjoyed as the erstwhile Soviet Union.

This lunar MoU is a continuation of the two nations’ geopolitical behavior on Earth, where China and Russia have established alternative security systems like the Shanghai Cooperation Organization and the Chinese-led Belt and Road Initiative (BRI), of which Russia is a participating country. By establishing an alternative lunar base development effort, China and Russia are questioning the legitimacy of the Artemis Accords and signaling that they do not view U.S. efforts, both public and private, as the only mechanism for cooperation in space

. Basically, this is clear indication that leadership in space is contested. Once they draw in enough partners and signatories to their lunar research base, China and Russia will have the power and influence to create an alternative state-centric preamble and lunar accord crafting the regulatory regime around lunar exploration and development. Both wield enormous clout internationally via their U.N. Security Council permanent memberships and veto power as well as advocacy in U.N. space bodies.

Signing an MoU for lunar development has several long-term strategic implications for both as well. First, Russia gets access to an international structure already in place under China’s BRI, in which nearly 140 countries are now participating. Both sides get access to launch sites, ground stations, and receiver stations in China and Russia, as well as access to a universal scientific talent pool, to include growing Chinese and Russian space expertise, and burgeoning employment opportunities in China where aerospace salaries are becoming globally competitive. They will also be able to divide the long-term costs of research and development. Finally, the MoU offers a rather flexible international partnership for countries. A decision on inclusion lies primarily with either Xi or Putin, unlike U.S. space partnerships, which have to pass through several interagency clearance processes and time-consuming bureaucratic procedures.

Strategic Regime Constriction

China and Russia have expressed opposition to the U.S. policy moves to enable the private sector and commercialization of space in Artemis Accords signatory countries, as well as national legislation like the U.S. Commercial Space Launch Competitive Act 2015 (CSLCA). Beijing and Moscow are especially worried by the prospect of the private space sector taking the lead in developing space technology breakthroughs. This implies fast enhancement of capability (think SpaceX and Blue Origin reusable rockets, lunar landers), truly democratizing space beyond just the state-owned institutions currently at the forefront of space policy, technology development, and missions. This has serious economic consequences in a globally competitive trillion-dollar space market. This aspect was evident in Kremlin spokesperson Dmitry Peskov’s vocal opposition to the U.S. focus on the privatization of space.

China, and to a larger extent Russia, do not yet have a vibrant private space sector capable of competing with the U.S. private sector globally, even though China under Xi has created enormous financial and ideological incentives for Chinese private space startups since 2014. China has, however, excelled in and utilized state-based policies to rein in its own private space sector under its strict Civil-Military Fusion Strategy and its new National Defense Law 2021.

The CSLCA, which supports U.S. private citizens’ ownership of space resources; the Artemis Accords’ emphasis on commercial activities on the moon, establishment of safety zones, and utilization of space resources; and the April 6, 2020 executive order calling for space resource utilization efforts based on international partnerships have galvanized the China-Russia MoU, an alternative lunar development mechanism led by authoritarian state-owned space agencies. Both China and Russia fear that with the Artemis Accords, the private space sector has been strengthened legally to invest in lunar breakthroughs that would take their own state-owned space agencies years to compete with or catch up to. They also fear that the Cold War-based space governance mechanisms that limit private development of space might be unraveling, especially if today’s leading space-faring states become flexible on the regulatory mechanisms set up during the Cold War that have stifled private innovation in space by creating incentives for state funded and owned space activities.

Innovation in technology will be a game changer in space going forward, and both China and Russia realize the impact of, say, SpaceX’s reusable heavy lift rocket, Starship, scheduled for launch by 2023, with plans for crewed missions to the moon and Mars (with orbital refueling). Starship will be the world’s most advanced reusable rocket, with a lift capacity of 100 metric tonnes to low earth orbit (LEO). In comparison, China has plans for a reusable Long March 8 rocket (with a lift capacity of 8.4 metric tonnes to LEO) designed by the state-owned China Academy of Launch Vehicle Technology (CALT), but this is clearly not in the same class of rockets like Starship.

Their vocal oppositions to the entry of the U.S. private space sector buys time for China and Russia to catch up over the next decade or so. By 2030, China has its own plans for a heavy lift rocket, the Long March 9, which will have a lift capacity of 140 metric tonnes to LEO, and also aspires to master reusability in the next 20 years. However, time is of the essence in space power projection and a single technology can change the game, as reusability has done for launch infrastructure.

A Changed Reality

China and Russia’s lunar base MoU has changed the alignment structures around space cooperation and sends a clear signal to the United States and the seven other Artemis Accords partners that space is contested. China and Russia are offering avenues for alternate partnership, especially to encourage countries like Saudi Arabia and Turkey to join, both of whom have aspirations to develop their space sector. Turkish President Recep Tayyip Erdogan recently announced Turkish ambitions to make first contact with the moon by 2023 (the 100th year celebration of the establishment of the Turkish republic) with the help of international partnerships.

Despite the U.S. private space sector advantages identified above, the U.S. suffers from a lack of continuity and emphasis in its space sector at the policy level due to changing space priorities across presidential administrations. We saw such uncertainty creep in with regard to its Artemis Accords (established under the Trump administration), the Space Force, and the reconstitution of the National Space Council after President Joe Biden was sworn in. Biden has offered little insight into his administration’s space priorities, including on critical concepts like space resource utilization and development. Such uncertainties can stifle international partnerships and technology development.

In contrast, despite lacking a similarly vibrant private sector, China’s clear articulation of its long-term steady lunar missions, and its ability to commit resources without having to worry about a change in missions with a change in administrations, showcases its long-term assurance that it can meet its goal of establishing a lunar base, now in partnership with Russia. While technology is a game changer, a nation cannot succeed in space without long-term strategic vision.

#### US space dominance prevents global war

**Zubrin 15** [(Robert Zubrin, president of Pioneer Energy, a senior fellow with the Center for Security Policy) “US Space Supremacy is Now Critical,” Space News, 1/22/15, https://spacenews.com/op-ed-u-s-space-supremacy-now-critical/] TDI

The United States needs a new national security policy. For the first time in more than 60 years, we face the real possibility of a large-scale conventional war, and we are woefully unprepared. Eastern and Central Europe is now so weakly defended as to virtually invite invasion. The United States is not about to go to nuclear war to defend any foreign country. So deterrence is dead, and, with the German army cut from 12 divisions to three, the British gone from the continent, and American forces down to a 30,000-troop tankless remnant, the only serious and committed ground force that stands between Russia and the Rhine is the Polish army. It’s not enough. Meanwhile, in Asia, the powerful growth of the Chinese economy promises that nation eventual overwhelming numerical force superiority in the region. How can we restore the balance, creating a sufficiently powerful conventional force to deter aggression? It won’t be by matching potential adversaries tank for tank, division for division, replacement for replacement. Rather, the United States must seek to totally outgun them by obtaining a radical technological advantage. This can be done by achieving space supremacy.To grasp the importance of space power, some historical perspective is required. Wars are fought for control of territory. Yet for thousands of years, victory on land has frequently been determined by dominance at sea. In the 20th century, victory on both land and sea almost invariably went to the power that controlled the air. In the 21st century, victory on land, sea or in the air will go to the power that controls space. The critical military importance of space has been obscured by the fact that in the period since the United States has had space assets, all of our wars have been fought against minor powers that we could have defeated without them. Desert Storm has been called the first space war, because the allied forces made extensive use of GPS navigation satellites. However, if they had no such technology at their disposal, the end result would have been just the same. This has given some the impression that space forces are just a frill to real military power — a useful and convenient frill perhaps, but a frill nevertheless. But consider how history might have changed had the Axis of World War II possessed reconnaissance satellites — merely one of many of today’s space-based assets — without the Allies having a matching capability. In that case, the Battle of the Atlantic would have gone to the U-boats, as they would have had infallible intelligence on the location of every convoy. Cut off from oil and other supplies, Britain would have fallen. On the Eastern front, every Soviet tank concentration would have been spotted in advance and wiped out by German air power, as would any surviving British ships or tanks in the Mediterranean and North Africa. In the Pacific, the battle of Midway would have gone very much the other way, as the Japanese would not have wasted their first deadly airstrike on the unsinkable island, but sunk the American carriers instead. With these gone, the remaining cruisers and destroyers in Adm. Frank Jack Fletcher’s fleet would have lacked air cover, and every one of them would have been hunted down and sunk by unopposed and omniscient Japanese air power. With the same certain fate awaiting any American ships that dared venture forth from the West Coast, Hawaii, Australia and New Zealand would then have fallen, and eventually China and India as well. With a monopoly of just one element of space power, the Axis would have won the war. But modern space power involves far more than just reconnaissance satellites. The use of space-based GPS can endow munitions with 100 times greater accuracy, while space-based communications provide an unmatched capability of command and control of forces. Knock out the enemy’s reconnaissance satellites and he is effectively blind. Knock out his comsats and he is deaf. Knock out his navsats and he loses his aim. In any serious future conventional conflict, even between opponents as mismatched as Japan was against the United States — or Poland (with 1,000 tanks) is currently against Russia (with 12,000) — it is space power that will prove decisive. Not only Europe, but the defense of the entire free world hangs upon this matter. For the past 70 years, U.S. Navy carrier task forces have controlled the world’s oceans, first making and then keeping the Pax Americana, which has done so much to secure and advance the human condition over the postwar period. But should there ever be another major conflict, an adversary possessing the ability to locate and target those carriers from space would be able to wipe them out with the push of a button. For this reason, it is imperative that the United States possess space capabilities that are so robust as to not only assure our own ability to operate in and through space, but also be able to comprehensively deny it to others. Space superiority means having better space assets than an opponent. Space supremacy means being able to assert a complete monopoly of such capabilities. The latter is what we must have. If the United States can gain space supremacy, then the capability of any American ally can be multiplied by orders of magnitude, and with the support of the similarly multiplied striking power of our own land- and sea-based air and missile forces be made so formidable as to render any conventional attack unthinkable. On the other hand, should we fail to do so, we will remain so vulnerable as to increasingly invite aggression by ever-more-emboldened revanchist powers. This battle for space supremacy is one we can win. Neither Russia nor China, nor any other potential adversary, can match us in this area if we put our minds to it. We can and must develop ever-more-advanced satellite systems, anti-satellite systems and truly robust space launch and logistics capabilities. Then the next time an aggressor commits an act of war against the United States or a country we are pledged to defend, instead of impotently threatening to limit his tourist visas, we can respond by taking out his satellites, effectively informing him in advance the certainty of defeat should he persist. If we desire peace on Earth, we need to prepare for war in space.

## IF TIME

### AT Biodiversity

#### Ecological tipping points are “scientific garbage” and lack data---effects are slow and localized

Brook et al. 18 — Barry W. Brook, ARC Australian Laureate Professor and Chair of Environmental Sustainability at the University of Tasmania in the Faculty of Science, Engineering & Technology, Erle C. Ellis, Ph.D., Cornell University, 1990 Professor, Geography & Environmental Systems University of Maryland, and Jessie C. Buettel, “What Is the Evidence for Planetary Tipping Points?” In Effective Conservation Science: Data Not Dogma, Chapter 8, Oxford University Press (2018). http://ecotope.org/people/ellis/papers/brook\_2018.pdf

\*The Nine Planetary Boundaries Brook Et Al. Refer Too Are, “Land-Use Change, Rate of Biodiversity Loss, Phosphorus Cycle, Global Freshwater Use, Ocean Acidification, Climate Change, Stratospheric Ozone Depletion, Atmospheric Aerosol Loading, Chemical Pollution, Terrestrial Net Primary Production, and Biodiversity Intactness”

As living standards, technological capacities,

and human welfare have continued to improve, concerns have mounted about possible natural limits to economic and population growth. Climate change, habitat loss, and recent extinctions are examples of impacts on natural systems that have been used as markers of global environmental degradation associated with the expanding influence of humans (Barnosky et al., 2012; McGill et al., 2015). Past civilizations have faced rapid declines and even collapsed in the face of regional environmental degradation, drought, and other environmental challenges (Scheffer, 2016; Butzer and Endfield, 2012). This begs the question of whether long-term societal relationships with the planet’s ecology may be approaching a global tipping point as the human population hurtles toward ten billion people. If this is indeed the case, the future of both biodiversity and humanity hangs in the balance. The hypothesis is that without urgent action to prevent reaching a global tipping point, the natural life support systems that sustain humanity may fail abruptly, with drastic consequences. 8.1 Regional tipping points yes— but what about global tipping points? There is strong evidence for rapid global shifts in the biosphere in the distant past, sometimes taking the form of mass extinction events, which have been linked to biophysical tipping points (Hughes et al., 2013). Tipping points occur when components of a system respond gradually to an external forcing to a point at which the response becomes nonlinear and abrupt. This response is often amplified through positive feedback interactions that induce an eventual state (or regime) shift (Lenton, 2013). Tipping points are well documented in studies of local ecosystems, such as lakes, that undergo regime shifts driven by alterations of energy or nutrient flows when thresholds are crossed and hysteresis prevails (Scheffer et al., 2015). Various tipping elements, some definite and others speculative, have also been noted in the Earth’s climate system (Lenton et al., 2008). Given this context, it would seem logical and indeed intuitive to conclude that the Earth system is susceptible and sensitive to planetary regime shifts caused by human alteration of Earth’s ecology. James Lovelock’s original Earth-system conception of “Gaia,” for instance, focused on interconnections and positive feedbacks between the geosphere and the biosphere, which act to promote stability and resilience (Lovelock and Margulis, 1974). But within this same framework, a temporary global forcing event, invoking disconnections and positive feedbacks, could lead to a rapid transition to an alternative stable state, as has been observed in many local systems (Kefi et al., 2016). This conceptual model invites the question of whether identifiable “boundaries” exist within the interacting components of the Earth system. If they do—and they are transgressed—then the planetary biosphere might be dramatically and permanently altered (Brook et al., 2013). 8.2 Planetary boundaries as a seductive policy framework The planetary boundaries concept, coined less than a decade ago (Rockström et al., 2009), represents the idea that contemporary societies have potentially transgressed the historical “natural” conditions— the “safe operating space”—under which human societies have historically thrived. However, to mark the boundaries of a planetary safe “reference state,” defined baselines are required. One possibility that has been suggested is the climatic conditions that marked the last 10 000 years of our current warm interglacial period, the Holocene, in which agricultural and urban societies first arose, should be used as a safe space (Steffen et al., 2015). Other safe spaces (or conversely boundaries) might be similarly recognized. In total, nine planetary boundaries have been hypothesized in association with Earth-system processes that, if sufficiently distorted, might potentially cause harmful changes in Earth’s functioning as a wholistic system (Table 8.1). This perspective has led some to postulate the potential breaching of critical thresholds, pushing the Earth out of the Holocene and consequently inducing a shift in the stability of the system (Barnosky et al., 2012). To quote: “Crossing these boundaries could generate abrupt or irreversible environmental changes.” (stockholmresilience.org/ research/planetary-boundaries.html). A hope often expressed is that flagging the crossing of these boundaries as a significant risk will provoke decision makers and the public into taking actions to mitigate harmful global changes (McAlpine et al., 2015). Such a framework, of global tipping points counterbalanced by secure safe spaces within planetary boundaries, is conceptually elegant and politically seductive. Notably, this implies two possible conditions—a state in which environmental change is without risk, and another in which risk is clear and action necessary. Such a framework is both constraining and liberating, and clearly defines a safe zone in which human societies may go about their activities without risk. As a consequence, if such clear knowledge on the risks of altering global environmental processes existed, a defined set of boundaries could be extremely useful to decision makers. But is there evidence of global tipping-point dynamics with safe space and global risk clearly demarcated? 8.3 The search for mechanisms and evidence in support of the nine planetary boundaries Since its original publication, the planetary boundaries framework, including the related concepts of a “safe operating space” and global regime shifts, have become increasingly prevalent in scientific and policy discussions concerned with global change (Corlett, 2015). This work has been heavily cited, updated, and actively promoted as a policy tool. But there has also been a counter-vailing critique that challenges the universality, utility, and even the underlying validity of the planetary boundaries framework (Brook and Blomqvist, 2016; Lenton and Williams, 2013). The underlying bases for this debate stem from disagreements over technical and scientific issues, including questions of scale, scientific underpinning, deterministic “boundary setting,” and the generality of mechanisms proposed. Most of the nine processes and systems listed in Table 8.1 lack theoretical mechanisms or evidence for a causal connection from local perturbations to global “boundary crossing” (Brook et al., 2013). The exceptions are the atmospheric and oceanic systems, which seem to most closely fit the characteristics required for a globally “scaled-up” version of the coupled, non-linear dynamics that have been shown to undergo phase shifts. But for others, like global land use or worldwide biodiversity, it is difficult to conceive how aggregated local-to-regional measures are representative of a coherent planetary system that is prone to tipping (Mace et al., 2014). Moreover, anthropogenic pressures vary geographically, and the system responses to stressors can be highly heterogeneous (Reyer et al., 2015). While global tipping points have been hypothesized, their exact “position” has not been determined. If the boundaries did exist at a global level, there is a good chance they could not be known until well after the regime shift or boundary crossing had occurred. This is because of our lack of our understanding of complex systems and the wild fluctuations in state variables that have occurred historically and continue to occur, without any evidence of an irreversible global collapse. Finally, implementing policies that avoid crossing planetary boundaries is a “global commons” problem, and everything we know from climate action indicates that it is difficult to generate agreements that address such risk when there is uncertainty about thresholds (Barrett and Dannenberg, 2012). 8.4 The problem with going from local process to a global tipping point For at least six of the nine proposed boundaries, the operational scales of these “Earth system processes” are local or regional (Table 8.1), yet the proposed boundaries represent global aggregations (the sum of many component sub-systems). The value assigned to any particular boundary is, in virtually all cases, speculative and represents an arbitrary point along a continuum of possible values, as opposed to a phase shift due to global non-linear dynamics. The most plausible threshold is for ocean acidification, because it is directly related to the calcite and aragonite compensation depth (i.e., something that is inherently quantifiable). The others are purely supported by a statement to the effect that “this stress or change from the baseline is deemed excessive.” This lack of scientific underpinning for these boundaries raises significant questions on the biological and physical relevance of such thresholds for the Earth system. What is currently needed are explicit efforts to link long-term monitoring to the choice of these boundary values (Robert et al., 2013). Unquestioning acceptance of these boundaries that in turn guide subsequent global assessment (as in Newbold et al., 2016) will only inhibit our understanding of human impacts. In addition to masking finer-grained detail, globally averaged or aggregated metrics are also often difficult to link to directed action. For instance, the recent Paris Agreement to limit average global temperature rise to less than 2 °C above pre-industrial levels was ultimately re-framed as a plethora of national goals or aspirations based on carbon-emissions intensity (Rogelj et al., 2016). This is partly because a “global temperature,” averaged across all the Earth system, is not a real physical phenomenon or quantity observed in any place. As such, it cannot be used to guide or monitor local system states. What can be monitored and altered are the trajectories of the underlying drivers of system changes (e.g., carbon emissions intensity, in the climate case), and these therefore ought to be the domain of targets. Even if one can identify and measure a global environmental attribute, it does not automatically follow that it is associated with a real-world threshold that, when crossed, leads to irreversible change. Asserting “safe” global limits on indicators like land-use change (the boundary of a maximum of 15% of land given over to cultivation, see Table 8.1) or decline in the local species abundance of originally present species (e.g., “10% loss relative to undisturbed habitat” as is the case in Newbold et al., 2016) is totally arbitrary. Such thinking ignores inherent complexity and promotes a “one size fits all” mode of thinking for conservation management that elides the very real need for locally appropriate solutions. Trying to avoid crossing a global land-use or biodiversity boundary might also lead to perverse outcomes locally, such as if restoring a “safe level” of biodiversity intactness in the world’s most fertile and productive regions (where most food originates) triggers undesirable trade-offs such as the displacement of farming to marginal regions that require more land, greater inputs, and hardship. In the context of food production, Running (2012) recently argued that at most an additional 10% of harvestable annual net global primary production (NPP) of terrestrial plants could be co-opted for future human use without crossing out of the planetary safe space. The implications of this assertion are draconian. Global NPP has been essentially steady, even with the massive agricultural expansion that has occurred over the last century. Thus, because the allocation of NPP is essentially a zerosum activity, asserting that humans can only get at most an additional 10% of that NPP implies future shortages of food, fiber, fodder, and fuel for people (Erb et al., 2012; Lewis, 2012). Policy based on this boundary would be fraught with human suffering, while the boundary itself has little mechanistic support or clear evidence of existence. In a similar vein, seeking to achieve uniform limits on practices such as nitrogen or phosphorus fertilizer use would inevitably lead to winners and losers at local scales (de Vries et al., 2013), because of differences in soil fertility and the legacies of historical farming practices (Erb et al., 2012; Carpenter and Bennett, 2011). For instance, while nitrogen fertilizer has been over-used in many developed countries, increases are urgently needed in sub-Saharan Africa to close the yield gap (Mueller et al., 2014). Given the consistent need for regionally appropriate limits, what practical use is a globally defined boundary? 8.5 Finding the research questions in an arena that is rife with competing visions of desirable futures Planetary boundaries are typically based on biogeochemical and ecological principles. Their frame is simple: if we pass threshold “X,” then the following ecological degradation or regime shift will occur. What this framing neglects is that there are inevitable trade-offs between human development goals and environmental protection/risk. Policy based on any assumed boundary will substantially impact development options. For the most part, truly natural areas are not the main “life support systems” for humanity; instead, people rely on those ecosystems that have been modified or engineered (Ellis et al., 2013). If it comes down to a choice between improved human development and the potential risk of transgressing an uncertain (and data poor) planetary boundary, it may be that society is willing to accept that risk. Science has a vital role in guiding environmental management. Ultimately, however, science must intersect with human decisions: physical laws are not negotiable, but our response to them is (Larsen et al., 2015). Global change is not a societal construct, so we must avoid the temptation to couch scientific models as policy directives. Value judgements do (and must) play a key role in determining how people respond to global environmental challenges and the possibility of inflexible planetary boundaries. What has become starkly apparent from the debate on planetary tipping points and possible global regime changes is the need for a concerted research agenda aimed at the potential links between biophysical and social systems to determine possible boundary “positions.” This research could come in the form of: (1) empirical examinations of regime shifts (or not) under gradual degradation; (2) models that explicitly link ecosystem changes and hypothesized boundaries to specific upheavals; and (3) explorations of how the framing of a boundary influences decision makers. For instance, our approach to Earth-system simulations is sophisticated for climatic components but lacks the resolution and mechanisms needed to test ideas on the planetary interconnectedness of nutrient and energy flows, or feedbacks across global biomes (Harfoot et al., 2014). The Madingley model of ecosystem dynamics (https://madingley.github. io/about) offers one promising example of an innovative attempt in this direction, because its design goals are to explicitly capture the scaling of processes that affect biodiversity from local to global scales (Purves et al., 2013). We can also seek a better understanding of the mechanistic underpinnings of the drivers of changes in global systems, such as land-use change and agricultural intensification. This could generate empirically based “bottomup” forecasts of trajectories, which, when linked to multi-ecosystem models, should improve our forecasts of the risks of planetary state shifts (Brook and Blomqvist, 2016). One of the appeals of planetary boundaries is the hypothesis that it resonates as a narrative for environmental action. The question is: how do decision-makers respond to these boundary arguments? Some research suggests that thresholds inhibit collective actions against tragedies of the commons (Barrett and Dannenberg, 2012). This is a field ripe for theoretical and empirical study. We also need to ask the hard questions about whether conceptual models like planetary boundaries the most effective strategy and engagement tool for conservation and mitigation are. The difficulty in getting international agreement on climate targets (e.g., the 2 °C “guardrail”) is an obvious case in point (Symons and Karlsson, 2015). Perhaps focusing on planetary opportunities: leverage points for guiding global change in better directions (e.g., carbon-neutral energy systems) is potentially a more effective focus of scientific attention (DeFries et al., 2012). By focusing on something to be averted as opposed to an outcome to be achieved, we risk breeding complacency on one side of a boundary, and hopelessness on the other. To summarize the above: the biosphere, and much of the geosphere, responds to external pressures in many and varied ways. The global human enterprise is driving large-scale changes in most components of the Earth system, but in a haphazard fashion, with responses often being weakly connected or transmitted slowly at a cross-continental scale. What we observe, for the global processes compiled in Table 8.1, is largely just the sum of all those changes. Acknowledging this reality should not be taken as diminishing the seriousness of these impacts or denying that major changes are occurring to the biosphere, atmosphere, and hydrosphere due to human activity. But it does make it implausible that the planet, or indeed most of its component systems, are primed to tip irreversibly to a radically different state that is inhospitable. Although the goal of sustainable stewardship of our planet is a laudable and an achievable one, the mechanisms and opportunities to conserve biodiversity and ecosystems lie mostly in targeted, localized actions (Jonas et al., 2014).